[0046] What is claimed is:

1. A method of forming an electric heater suitable for heating molten metal, the electric heater comprised of a tube having a closed end for immersing in the molten metal, the tube comprised of a composite material, the method comprising the steps of:

(a) providing a tube having a coefficient of thermal expansion less than 8×10^{-6} in/in/°F and having an outside surface;

(b) applying a bond coat to the outside surface;

(c) applying a refractory coating to said bond coat;

(d) applying a metal sealant to said refractory;

(e) converting said metal sealant to provide a transformed metal sealant resistant to reaction by said molten metal; and

(f) locating an electric heating means in said tube.

2. The method in accordance with claim 1 including applying said metal sealant by vapor deposition.

3. The method in accordance with claim 1 including applying said metal sealant by immersing in molten metal sealant.

4. The method in accordance with claim 1 wherein said metal tube is fabricated from a metal selected from the group consisting of titanium, titanium alloys, stainless steel, nickel based alloys and iron based alloys.

5. The method in accordance with claim 1 wherein said bond coating comprises an alloy selected from the group consisting of Cr-Ni-Al alloy, a Cr-Ni-Al-Y alloy and a Cr-Ni alloy.

6. The method in accordance with claim 1 wherein said refractory coating is selected from the group consisting of one of Al_2O_3, ZrO_2, Y_2O_3 stabilized ZrO_2, SiAlON and Al_2O_3-TiO_2.

7. The method in accordance with claim 1 wherein said metal sealant is selected from the group consisting of Mg, Al, Zn, Ca and Y.

8. The method in accordance with claim 1 wherein said oxidized metal sealant is magnesium oxide.

9. The method in accordance with claim 1 including converting the said metal sealant to a metal oxide.

10. An electric heater assembly suitable for immersion heating molten metal, the electric heater assembly comprised of

a tube having a closed end suitable for immersing in molten metal, the tube fabricated from a composite material comprised of a case having a coefficient of thermal expansion of less than 10×10^{-6} in/in/°F and having an outer surface coated with a refractory coating having a coefficient of thermal expansion less than 10×10^{-6} in/in/°F;

the refractory coating having a metal sealant applied thereto, the metal sealant oxidized to provide an oxidized metal sealant in pores of the refractory coating, the oxidized metal sealant resistant to attack by said molten metal.

11. The electric heater in accordance with claim 10 wherein the metal case is selected from a metal selected from the group consisting of titanium, titanium alloys, stainless steel, nickel based alloys and iron based alloys.

12. The method in accordance with claim 10 wherein said metal sealant is selected from the group consisting of Mg, Al, Zn, Ca and Y.

13. The method in accordance with claim 10 wherein said oxidized metal sealant is magnesium oxide.

14. A method of forming an electric heater suitable for heating molten metal, the electric heater comprised of a tube having a closed end for immersing in the molten metal, the tube comprised of a composite material, the method comprising the steps of:

(a) providing a metal tube having a coefficient of thermal expansion less than 8×10^{-6} in/in/°F and having an outside surface;

(b) applying a bond coat to the outside surface;

(c) applying a refractory coating to said bond coat;

(d) heating said refractory coating to cause formation of micro cracks and to form oxides of metals comprising said bond coat and metal tube in said micro cracks to render said refractory coating resistant to corrosive attack by said molten metal; and

(e) locating an electric heating means in said tube.

15. The method in accordance with claim 14 including heating said coating to a temperature range of 400° to 2200°F.

16. The method in accordance with claim 14 wherein said metal tube is fabricated from a metal selected from the group consisting of titanium, titanium alloys, stainless steel, nickel based alloys and iron based alloys.

17. The method in accordance with claim 14 wherein said bond coating comprises an alloy selected from the group consisting of Cr-Ni-Al alloy, a Cr-Ni-Al-Y alloy and a Cr-Ni alloy.

18. The method in accordance with claim 14 wherein said refractory coating is selected from the group consisting of one of Al_2O_3, ZrO_2, Y_2O_3 stabilized ZrO_2, SiAlON and Al_2O_3-TiO_2.

19. An electric heater assembly suitable for immersion heating molten metal, the electric heater assembly comprised of

a tube having a closed end suitable for immersing in molten metal, the tube fabricated from a composite material comprised of a metal case having a coefficient of thermal expansion of less than 10×10^{-6} in/in/°F and having an outer surface coated with a refractory coating having a coefficient of thermal expansion less than 10×10^{-6} in/in/°F;

the refractory coating oxidized by heating in a temperature range of 400° to 2200°F to provide an oxidized metal in micro cracks of the refractory coating, the oxidized metal rendering the refractory coating resistant to attack by said molten metal.

20. The electric heater in accordance with claim 19 wherein the metal case is selected from a metal selected from the group consisting of titanium, titanium alloys, stainless steel, nickel based alloys and iron based alloys.

21. The method in accordance with claim 19 wherein said refractory coating is selected from the group consisting of one of Al_2O_3, ZrO_2, Y_2O_3 stabilized ZrO_2, SiAlON and Al_2O_3-TiO_2.

22. The method in accordance with claim 19 wherein said bond coating comprises an alloy selected from the group consisting of Cr-Ni-Al alloy, a Cr-Ni-Al-Y alloy and a Cr-Ni alloy.